PROGRESSION OF THE FLEX REACTOR CONCEPT DESIGN

Over the past two years, our team at Warrington has methodically worked through the various systems and components of the FLEX reactor, testing and refining design assumptions, and building a robust safety case. The primary goal of this work was to bring our concept design to a point where detailed engineering design could meaningfully commence. This goal has been achieved.

However, this progress occurred against the backdrop of rapid cost escalation across the energy industry. For example, wind turbine developers walked away from strike price contracts because they could no longer operate profitably. In nuclear energy, one of the significant economic impacts has been the increased cost of uranium enrichment, with prices doubling since 2020. This, coupled with large increases in concrete and steel prices, has driven up all nuclear plant costs.

Cost has always been the driving factor behind our plans for the FLEX reactor. We believe that to truly decarbonize the planet, we need to reduce energy costs below those of coal and gas. Therefore, we were delighted to find that we had maintained our already world-beating low cost following this design analysis and development, which is not always the case in the nuclear industry. Two design factors, in particular, enabled this achievement.

Increased power from the same reactor core

The FLEX reactor is unique in using only natural convection of our patented coolant salt to remove heat from the reactor core. This approach offers huge advantages in safety and simplicity but limits its power output. One of our development analyses aimed to determine the maximum power that could be removed in this way while maintaining excellent safety margins. We discovered that changing the alloy used for our fuel tubes to one developed for, and widely used in, coal-fired power stations allowed a 50% increase in core power without compromising safety or performance. This change reduced our capital cost per MW by a third, roughly offsetting the recent increases in material costs.

More frequent refuelling

Initially, our intention was for the FLEX reactor to only require refueling every 15 years. This meant that all the enriched uranium needed for those 15 years of operation had to be purchased when the reactor was commissioned. However, with doubled enrichment costs and rapidly increasing interest rates making capital much more expensive, the real cost of such infrequent refueling became a significant problem.

Therefore, we revised our refueling interval to five years, roughly offsetting the impact of higher uranium enrichment costs and increased capital costs, even when accounting for the increased costs of refueling three times more frequently. Incidentally, but usefully, this change also increased the amount of energy we could extract from a given amount of enriched uranium.

Is this progress?

We would love to be able to say that these two improvements further reduced our costs in comparison to where we were three years ago when the FLEX reactor was conceived. Sadly, we cannot claim that. However, maintaining these costs at our world-leading low level in a time of rapid cost escalation across the entire power industry is a triumph of which we are very proud.